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Supercapacitive bioelectrochemical solar cells using thylakoid membranes and carbon nanotubes

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Utilization of photosynthetic cell components for light energy harnessing is a perspective tool to achieve a high efficiency of “green” light energy conversion using fully recyclable biomaterials. Inspired by the advantages of recently disclosed concept of simultaneous light energy conversion and storage in the form of electric charge within a singular contrivance [1, 2], we have developed and investigated supercapacitive photo-bioanodes based on the carboxilized and amidized multi-walled carbon nanotubes (MWCNTs) in direct electron transfer (DET) communication with adsorbed thylakoid membranes.

Employment of the amidized MWCNTs results in higher photo-bioelectrocatalytic current output, lower charge transfer resistance and open circuit potential and higher operational stability compared to the photo-bioanodes based on the carboxilized MWCNTs.

The average power density achieved for the optimized supercapacitive photo-bioelectrochemical cell in a pulse mode was *ca*. 250 times higher compared to the recent report about the DET-based photo-biosupercapacitor coupled with significantly higher stability and simple design [3].

The findings reported herein disclose new patterns of interactions between the biomaterial and charged surface and may facilitate the development of more efficient, eco-friendly and renewable biological power sources for various application perspective.

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